



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
[www.uspto.gov](http://www.uspto.gov)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/701,047	11/04/2003	Jingsong Xia	31075-128	5532
7590	01/11/2005		EXAMINER	
Troy J. Cole Suite 3700 Bank One Center/Tower 111 Monument Circle Indianapolis, IN 46204-5137			TRAN, KHANH C	
			ART UNIT	PAPER NUMBER
			2631	
			DATE MAILED: 01/11/2005	

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/701,047	XIA ET AL.	
	Examiner Khanh Tran	Art Unit 2631	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 27 October 2004.  
 2a) This action is **FINAL**.                    2b) This action is non-final.  
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1-5,7-9 and 12-53 is/are pending in the application.  
 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
 5) Claim(s) 1-5,22-30,39 and 42-44 is/are allowed.  
 6) Claim(s) 31,36,40 and 41 is/are rejected.  
 7) Claim(s) 7-9,12-21,32-35,37,38 and 45-53 is/are objected to.  
 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.  
 10) The drawing(s) filed on 04 November 2003 is/are: a) accepted or b) objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
 a) All    b) Some \* c) None of:  
 1. Certified copies of the priority documents have been received.  
 2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | Paper No(s)/Mail Date. _____  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>01/07/2004</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
|   | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

1. The Second Preliminary Amendment filed on 10/27/2004 has been entered.

Claims 1-5, 7-9, and 12-53 are pending in this Office action.

### ***Claim Objections***

2. Claim 7 is objected to because of the following informalities: in line 8, "the error signal" should be changed to -- an error signal --; in line 10, "the coefficients" should be changed to -- coefficients of the taps of the FIR filter and the decision feedback equalizer --. Appropriate correction is required.

3. Claim 12 is objected to because of the following informalities: in line 22, "the the" should be changed to -- the --; in line 23, "decision device output signal" should be changed to -- decision error signal --. Appropriate correction is required.

4. Claim 14 is objected to because of the following informalities: in line 1, "the method" should be changed to -- the adaptive equalizer --. Appropriate correction is required.

5. Claim 15 is objected to because of the following informalities: in line 1, "the method" should be changed to -- the adaptive equalizer --. Appropriate correction is required.

6. Claim 16 is objected to because of the following informalities: in line 1, “the method” should be changed to -- the adaptive equalizer --. Appropriate correction is required.

7. Claim 17 is objected to because of the following informalities: in line 18, “the decision device output signal” should be changed to -- decision device input signal --. Appropriate correction is required.

8. Claim 19 is objected to because of the following informalities: in line 1, “the method” should be changed to -- the adaptive equalizer --; in line 1, “the received information-bearing signal” should be changed to -- a received information-bearing input signal --. Appropriate correction is required.

9. Claim 20 is objected to because of the following informalities: in line 1, “the method” should be changed to -- the adaptive equalizer --; in line 1, “the received information-bearing signal” should be changed to -- a received information-bearing input signal --. Appropriate correction is required.

10. Claim 21 is objected to because of the following informalities: in line 1, “the method” should be changed to -- the adaptive equalizer --; in line 1, “the received information-bearing signal” should be changed to -- a received information-bearing input signal --. Appropriate correction is required.

11. Claim 41 is objected to because of the following informalities: in line 2, "the decoder" should be changed to -- decoder --. Appropriate correction is required.

12. Claim 45 is objected to because of the following informalities: in line 2, "the decoder symbol signal" should be changed to -- the error-corrected decoder symbol signal --. Appropriate correction is required.

13. Claim 49 is objected to because of the following informalities: in line 17, "the decoder symbol signal" should be changed to -- the error-corrected decoder symbol signal --. Appropriate correction is required.

14. Claim 50 is objected to because of the following informalities: in line 2, "the decoder symbol signal" should be changed to -- the error-corrected decoder symbol signal --; in line 2, "mapped and scaled" should be changed to -- error-corrected mapped and scaled --. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

15. Claim 40 is rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for "mapping output 229 of the trellis decoder 350" as

shown in figure 8, and on page 16 lines 9-16 of the original disclosure, does not reasonably provide enablement for “mapping the decision error signal” as set forth in the application claim. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims.

Referring to page 16 lines 9-16, see also figure 8, of the original disclosure. Output 229 of the trellis decoder is mapped and scaled back to data bits. Claim 40 claims the step of mapping the decision error signal to produce a mapped symbol output, which is not enabled by the specification. The subsequent claim step “subtracting the equalizer output signal from the mapped symbol output to produce the decision error signal” is also not enabled by the specification. Referring to page 16 lines 9-16, see also figure 8, the error 723, corresponding to the decision error signal in the claim, is generated from the difference between the output 299 of the equalizer 800 and the output 229 of the trellis decoder 350.

16. Claim 41 is also rejected for being dependent on rejected claim 40.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

17. Claims 31 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tan et al. U.S. Patent 6,226,323 in view of admitted prior art in the original disclosure.

Regarding claim 31, figure 24 illustrates a decision feedback equalizer circuit including a trellis coded modulation decoder circuit. In column 24, lines 20 through column 25 line 5, see also figure 24, the decision feedback equalizer circuit includes a feedforward (FFE) equalizer 328, a decision feedback (DFE) 322, a TCM decoder or a Viterbi decoder 320. FFE 328 and DFE 322 comprise a plurality of coefficient taps, which are updated by an error term through summing 334. Figure 24 shows the means for updating coefficient taps of DFE 322, however, figure 24 does not show the means for updating coefficient taps of FFE 328. In view of the foregoing, the decision feedback equalizer circuit, as taught by Tan et al., corresponds to the claimed adaptive equalizer in the preamble.

Referring back to figure 24, the information-bearing signal is received through FFE 328 and an equalizer output signal is generated through the summer 342.

The equalizer output signal is passed through the Viterbi decoder 320 to be decoded, and a decoded symbol signal is generated.

The decoded symbol signal is also error-corrected through the Viterbi decoder 320 producing an error-corrected decoded symbol signal as shown in figure 24. Tan et al. does not expressly disclose the foregoing step producing a

symbol reliability signal. However, in figure 24, column 24 line 52 via column 25 line 3, the Viterbi 320 includes a path metrics module 344 and a path memory module 346 in addition to the decision device 340. The Viterbi selects the best path memory stored in the path memory module 346 and the path metrics stored in the path metrics module 344. The path memory module 346 includes a historical record of a particular number of past decisions. Tan et al. further teaches that any one of a number of historical decisions may be taken from the path memory 346 and provided to both the DFE 322 and an error term generating summing junction 334 by selecting the appropriate historical signal through a multiplex circuit 348. On page 15, lines 4-10, of the original disclosure, Applicants admit that it will be appreciated that the reliability signal can be generated from any stage in the trellis decoder. Since the number of historical decisions is representative of different stages in the Viterbi decoder, it would have been obvious for one of ordinary skill in the art at the time the invention was made that any one of a number of historical decisions corresponds to the claimed symbol reliability, and outputting of any one of a number of historical decisions correspond to producing the claimed symbol reliability signal. Furthermore, the number of historical decisions is related to the error-corrected decoded symbol signal as appreciated by one of ordinary skill in the art. The error-corrected decoded symbol signal, which is output of the Viterbi decoder 320, is error free.

The error term through the summing junction 334 is used to drive the coefficient tap update of the FFE 328, as well as the coefficient tap update of the

DFE 322 based on one of a number of historical decisions, the one historical decision corresponding to the claimed symbol reliability signal as discussed above.

Regarding claim 36, figure 24 illustrates a decision feedback equalizer circuit including a trellis coded modulation decoder circuit. In column 24, lines 20 through column 25 line 5, see also figure 24, the decision feedback equalizer circuit includes a feedforward (FFE) equalizer 328, a decision feedback (DFE) 322, a TCM decoder or a Viterbi decoder 320. FFE 328 and DFE 322 comprise a plurality of coefficient taps, which are updated by an error term through summing 334. Figure 24 shows the means for updating coefficient taps of DFE 322, however, figure 24 does not show the means for updating coefficient taps of FFE 328. In view of the foregoing, the decision feedback equalizer circuit, as taught by Tan et al., corresponds to the claimed adaptive equalizer in the preamble.

As recited above, FFE 328 and DFE 322 comprise a plurality of coefficient taps governing a response of the decision feedback equalizer circuit in figure 24.

As recited above, figure 24 shows the means for updating coefficient taps of DFE 322, however, figure 24 does not show the means for updating coefficient taps of FFE 328. Summing 322 can be considered to be part of the means for modifying the plurality of coefficients of the adaptive equalizer as appreciated by one of ordinary skill in the art.

The Viterbi decoder 320 corresponds to the claimed error-correcting decoder. Tan et al. does not expressly disclose the Viterbi decoder 320 producing a symbol reliability signal as claimed in the instant application. However, in figure 24, column 24 line 52 via column 25 line 3, the Viterbi 320 includes a path metrics module 344 and a path memory module 346 in addition to the decision device. The Viterbi selects the best path memory stored in the path memory module 346 and the path metrics stored in the path metrics module 344. The path memory module 346 includes a historical record of a particular number of past decisions. Tan et al. further teaches that any one of a number of historical decisions may be taken from the path memory 346 and provided to both the DFE 322 and an error term generating summing junction 334 by selecting the appropriate historical signal through a multiplex circuit 348. On page 15, lines 4-10, of the original disclosure, Applicants admit that it will be appreciated that the reliability signal can be generated from any stage in the trellis decoder. Since the number of historical decisions is representative of different stages in the Viterbi decoder, it would have been obvious for one of ordinary skill in the art at the time the invention was made that any one of a number of historical decisions corresponds to the claimed symbol reliability, and outputting of any one of a number of historical decisions correspond to producing the claimed symbol reliability signal.

The one of a number of historical decisions is provided to an error term generating summing function 334 in which the error term drives the coefficient

tap update of the FFE 328 as well as the coefficient tap update of the DFE 322.

Hence, a magnitude of the one of a number of historical decisions is used to adapt the plurality of coefficients.

### ***Allowable Subject Matter***

18. Claims 1-5 are allowed.

Regarding claim 1, the claim is allowed over prior art of record since the cited references, taken individually or in combination, fail to particularly disclose an adaptive equalizer comprising uniquely distinct features "wherein an error signal is generated by subtracting the decision feedback output from the decision device output, the error being used to update coefficients of the taps of the FIR filter and the decision feedback equalizer" and "wherein a magnitude of the change to the coefficients is selected based at least in part the reliability output of the trellis decoder". It is noted that the closest prior art, Nicolas et al. (US 5,453,797) and Tan et al. (US 6,226,323 B1), discloses a similar adaptive equalizer, however, fails to anticipate or render the above underlined limitations obvious.

19. Claims 7-9 are allowed.

Regarding claim 7, the claim is allowed over prior art of record since the cited references, taken individually or in combination, fail to particularly disclose an adaptive equalizer comprising uniquely distinct features "wherein an error signal is generated by

delaying the decision feedback output and subtracting it from the decoded output" and  
"wherein a magnitude of change in coefficients of the taps of the FIR filter and the  
decision feedback equalizer is selected based at least in part upon the reliability output".

It is noted that the closest prior art, Nicolas et al. (US 5,453,797) and Tan et al. (US 6,226,323 B1), discloses a similar adaptive equalizer, however, fails to anticipate or render the above underlined limitations obvious.

20. Claims 12-16 are allowed.

Regarding claim 12, the claim is allowed over prior art of record since the cited references, taken individually or in combination, fail to particularly disclose an adaptive equalizer comprising uniquely distinct features "a decision error signal created by operably combining the equalizer output signal and the decision device output signal" and "a reliability-decision directed adaptation signal created by operably combining the decision error signal with the symbol reliability output signal". It is noted that the closest prior art, Nicolas et al. (US 5,453,797) and Tan et al. (US 6,226,323 B1), discloses a similar adaptive equalizer, however, fails to anticipate or render the above underlined limitations obvious.

21. Claims 17-21 are allowed.

Regarding claim 17, the claim is allowed over prior art of record since the cited references, taken individually or in combination, fail to particularly disclose an adaptive equalizer comprising uniquely distinct features "a symbol mapper operably coupled to

the error-corrected symbol output signal and providing a mapped and scaled symbol output signal" and "a decision error signal created by operably combining the equalizer output signal and the mapped and scaled symbol output signal" and "a reliability-decision directed adaptation signal created by operably combining the decision error signal with the output of the symbol reliability output". It is noted that the closest prior art, Nicolas et al. (US 5,453,797) and Tan et al. (US 6,226,323 B1), discloses a similar adaptive equalizer, however, fails to anticipate or render the above underlined limitations obvious.

22. Claims 22-30 are allowed.

Regarding claim 22, the claim is allowed over prior art of record since the cited references, taken individually or in combination, fail to particularly disclose a method for creating a reliability-decision directed adaptation signal for adapting an adaptive equalizer, the method comprising uniquely distinct features "combining operatively the error-corrected symbol output signal and the equalizer output signal to produce a decision error signal" and "combining operatively the decision error signal and the symbol reliability output signal to produce the reliability-decision directed adaptation signal". It is noted that the closest prior art, Nicolas et al. (US 5,453,797) and Tan et al. (US 6,226,323 B1), discloses a similar adaptive equalizer, however, fails to anticipate or render the above underlined limitations obvious.

23. Claims 32-34, 37-38 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

24. Claims 39, 42 are allowed.

Regarding claim 39, the claim is allowed over prior art of record since the cited references taken individually or in combination fails to particularly disclose a method for creating a reliability-decision directed adaptation signal for adapting an adaptive equalizer, the method comprising uniquely distinct features "operably combining the decision device output signal and the equalizer output signal to create a decision error signal" and "operably combining the decision error signal and the symbol reliability signal to produce the reliability-decision directed adaptation signal". It is noted that the closest prior art, Nicolas et al. (US 5,453,797) and Tan et al. (US 6,226,323 B1), discloses a similar adaptive equalizer, however, fails to anticipate or render the above underlined limitations obvious.

25. Claims 43-48 are allowed.

Regarding claim 43, the claim is allowed over prior art of record since the cited references taken individually or in combination fails to particularly disclose a method for adapting a response of an adaptive equalizer, the method comprising uniquely distinct features "forming a reliability-decision directed adaptation signal related to the error-corrected decoder symbol signal by operably combining the equalizer output signal,

error-corrected decoder symbol signal and the symbol reliability signal". It is noted that the closest prior art, Nicolas et al. (US 5,453,797) and Tan et al. (US 6,226,323 B1), discloses a similar adaptive equalizer, however, fails to anticipate or render the above underlined limitations obvious.

26. Claims 49-53 are allowed.

Regarding claim 49, the claim is allowed over prior art of record since the cited references taken individually or in combination fails to particularly disclose a method for adapting a response of an adaptive equalizer, the method comprising uniquely distinct features "forming a reliability-decision directed adaptation signal related to the error-corrected decoder symbol signal by operably combining the equalizer output signal, error-corrected decoder symbol signal and the symbol reliability signal". It is noted that the closest prior art, Nicolas et al. (US 5,453,797) and Tan et al. (US 6,226,323 B1), discloses a similar adaptive equalizer, however, fails to anticipate or render the above underlined limitations obvious.

### **Conclusion**

27. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

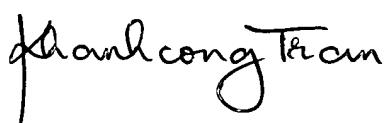
The Examiner does not cite any references at this moment, because Applicants have already cited references searched by the Examiner.

28. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh Tran whose telephone number is 571-272-3007. The examiner can normally be reached on Monday - Friday from 08:00 AM - 05:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad Ghayour can be reached on 571-272-3021. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KCT

  
Examiner

01/07/2005

KHANH TRAN